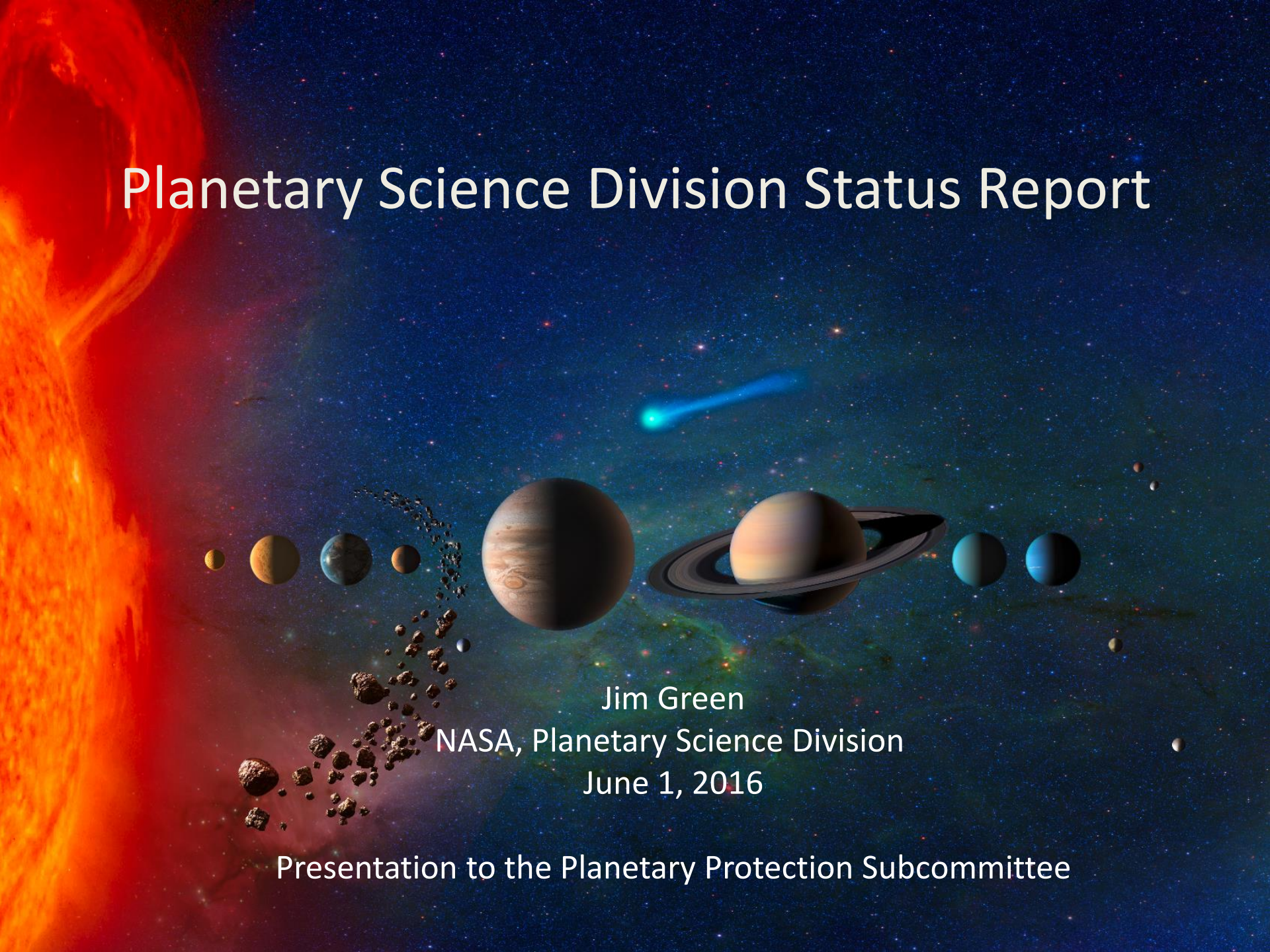
Planetary Science Division Status Report

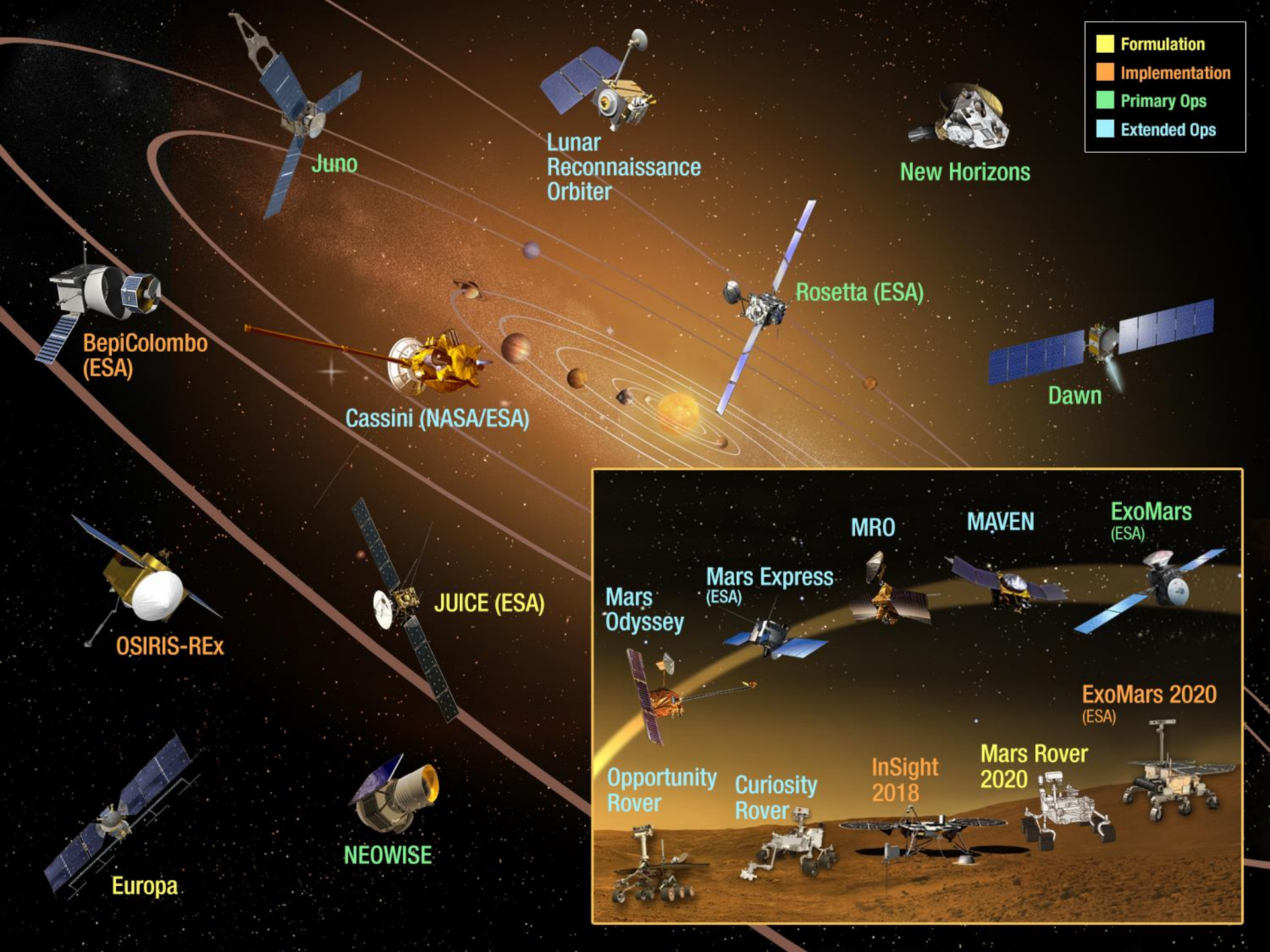


Jim Green
NASA, Planetary Science Division
June 1, 2016

Presentation to the Planetary Protection Subcommittee

Outline

- Mission Overview
- Discovery & New Frontiers Programs
- Mars Exploration Program - *Michael Meyer*
- Europa mission
- NRC studies and schedule for the mid-term


Formulation
Implementation
Primary Ops
Extended Ops
Juno
Lunar Reconnaissance Orbiter
New Horizons
BepiColombo (ESA)
Rosetta (ESA)
Cassini (NASA/ESA)
Dawn
OSIRIS-REx
JUICE (ESA)
Europa
NEOWISE
MRO
MAVEN
ExoMars (ESA)
Mars Express (ESA)
Mars Odyssey
ExoMars 2020 (ESA)
Opportunity Rover
Curiosity Rover
InSight 2018
Mars Rover 2020

Planetary Science Missions Events

2014

July – *Mars 2020* Rover instrument selection announcement *** Completed**

August 6 – 2nd Year Anniversary of *Curiosity* Landing on Mars

September 21 – *MAVEN* inserted in Mars orbit

October 19 – Comet Siding Spring encountered Mars

September – *Curiosity* arrives at Mt. Sharp

November 12 – ESA's *Rosetta* mission lands on Comet Churyumov–Gerasimenko

December 2/3 – Launch of *Hayabusa-2* to asteroid 1999 JU_3

2015

March 6 – *Dawn* inserted into orbit around dwarf planet Ceres

April 30 – *MESSENGER* spacecraft impacted Mercury

May 26 – Europa instrument Step 1 selection

July 14 – *New Horizons* flies through the Pluto system

September – Discovery 2014 Step 1 selection

December 6 – *Akatsuki* inserted into orbit around Venus

2016

March – Launch of ESA's *ExoMars Trace Gas Orbiter*

July 4 – *Juno* inserted in Jupiter orbit

July 20 – 40th Anniversary of the Viking missions

September 8 – Launch of Asteroid mission *OSIRIS – REx* to asteroid Bennu

Cassini begins plane change maneuver for the "Grand Finale"

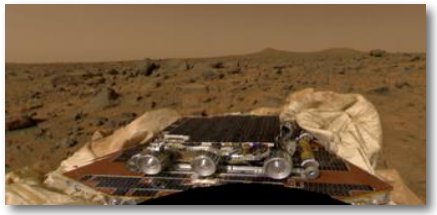
Late 2016 – Discovery 2014 Step 2 selection

Discovery Program

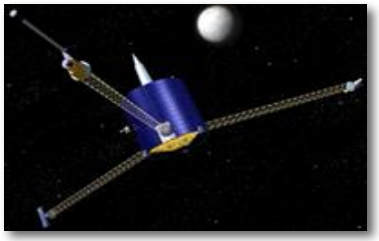
Discovery Program

Completed

Mars evolution:
Mars Pathfinder (1996-1997)

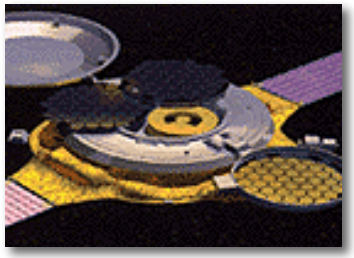


Lunar formation:
Lunar Prospector (1998-1999)



NEO characteristics:
NEAR (1996-1999)

Solar wind sampling:
Genesis (2001-2004)

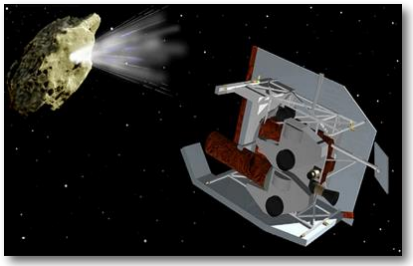


Completed

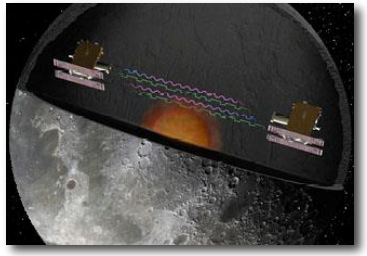
Comet diversity:
CONTOUR (2002)

Nature of dust/coma:
Stardust (1999-2011)

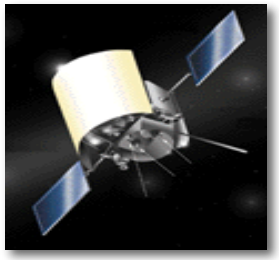
Comet internal structure:
Deep Impact (2005-2012)



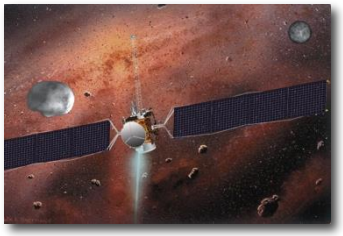
Lunar Internal Structure
GRAIL (2011-2012)



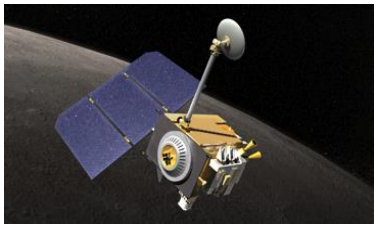
Mercury environment:
MESSENGER (2004-*2015*)



Main-belt asteroids:
Dawn (2007-*2016*)



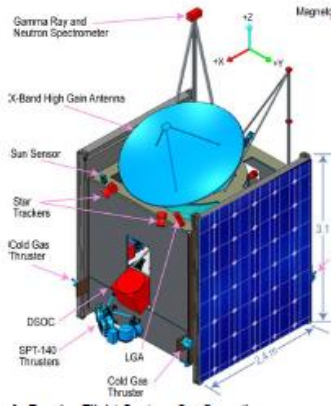
Lunar surface:
LRO (2009-*TBD*)



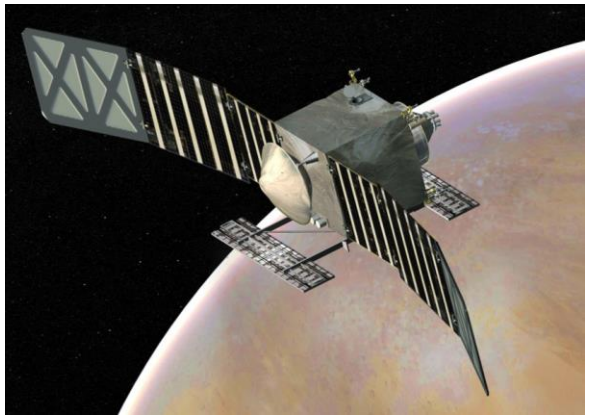
ESA/Mercury Surface:
Strofio (*2017-TBD*)

Mars Interior:
InSight (*2018*)

Discovery Selections 2014



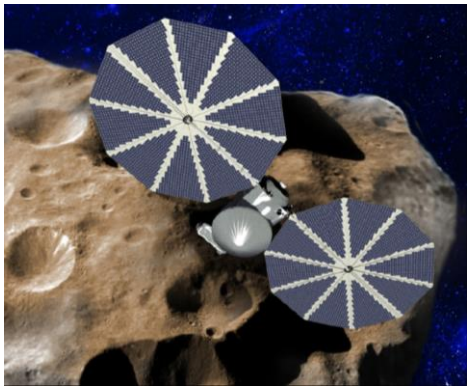
Psyche: Journey to a Metal World
PI: Linda Elkins-Tanton, ASU
Deep-Space Optical Comm (DSOC)



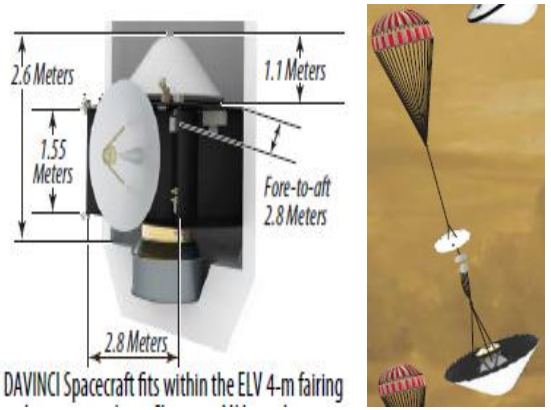
VERITAS: Venus Emissivity, Radio Science, InSAR, Topography, And Spectroscopy
PI: Suzanne Smrekar, JPL
Deep-Space Optical Comm (DSOC)

NEOCam:
Near-Earth Object Camera
PI: Amy Mainzer, JPL
Deep-Space Optical Comm (DSOC)

Down-select in December 2016



Lucy: Surveying the Diversity of Trojan Asteroids
PI: Harold Levison, Southwest Research Institute (SwRI)
Advanced Solar Arrays



DAVINCI: Deep Atmosphere Venus Investigations of Noble gases, Chemistry, and Imaging
PI: Lori Glaze, GSFC

New Frontiers Program

New Frontiers Program

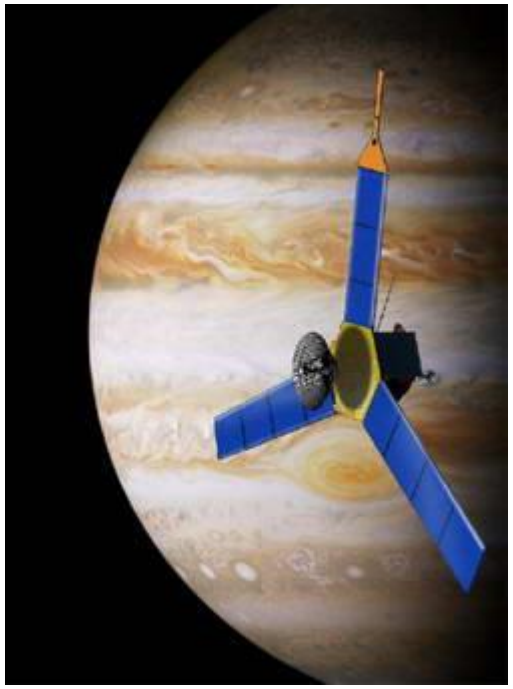
1st NF mission
New Horizons:

Pluto-Kuiper Belt

Launched January 2006
Flyby July 14, 2015
PI: Alan Stern (SwRI-CO)

2nd NF mission
Juno:

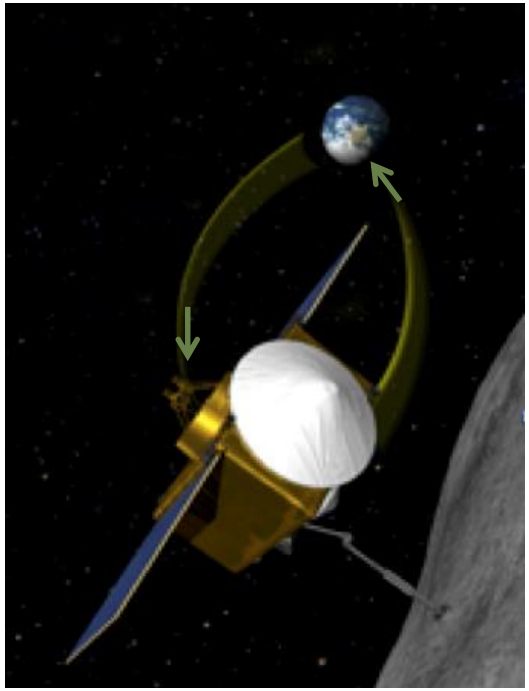
Jupiter Polar Orbiter



Launched August 2011
Arrives July 4, 2016
PI: Scott Bolton (SwRI-TX)

3rd NF mission
OSIRIS-REx:

Asteroid Sample Return



Launch readiness: Sept. 8, 2016
Arrives August 2018
PI: Dante Lauretta (UA)

Next New Frontiers Program AO

- Community Announcement Regarding New Frontiers Program issued in January 2016
- Investigations are limited to the following mission themes (listed without priority):
  - Comet Surface Sample Return
  - Lunar South Pole-Aitken Basin Sample Return
  - Ocean Worlds (Titan, Enceladus)
  - Saturn Probe
  - Trojan Tour and Rendezvous
  - Venus In Situ Explorer
- Draft AO to be released by end of Fiscal Year 2016

Next New Frontiers AO Time Frame

Notional Schedule:

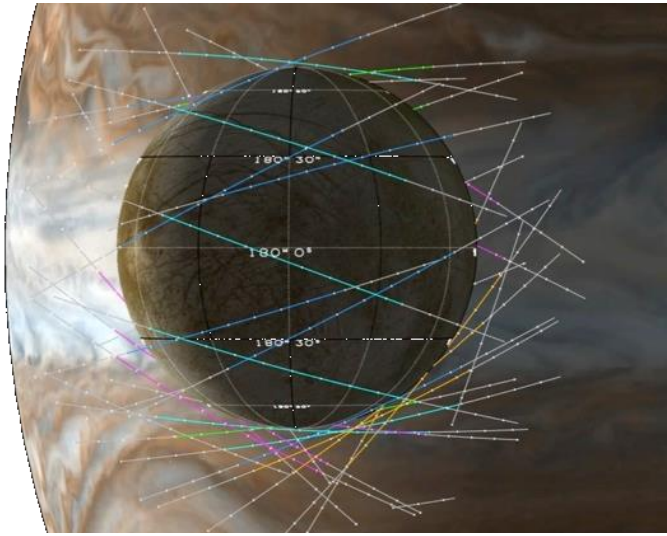
- Release of final AO…… January 2017 (target)
- Preproposal conference…… ~3 weeks after final AO release
- Proposals due …… ~90 days after AO release
- Selection for competitive Phase A …. November 2017 (target)
- Concept study reports due……. October 2018 (target)
- Down-selection …… May 2019 (target)
- KDP B …….. August 2019 (target)
- Launch readiness date …… 2024

Europa Mission

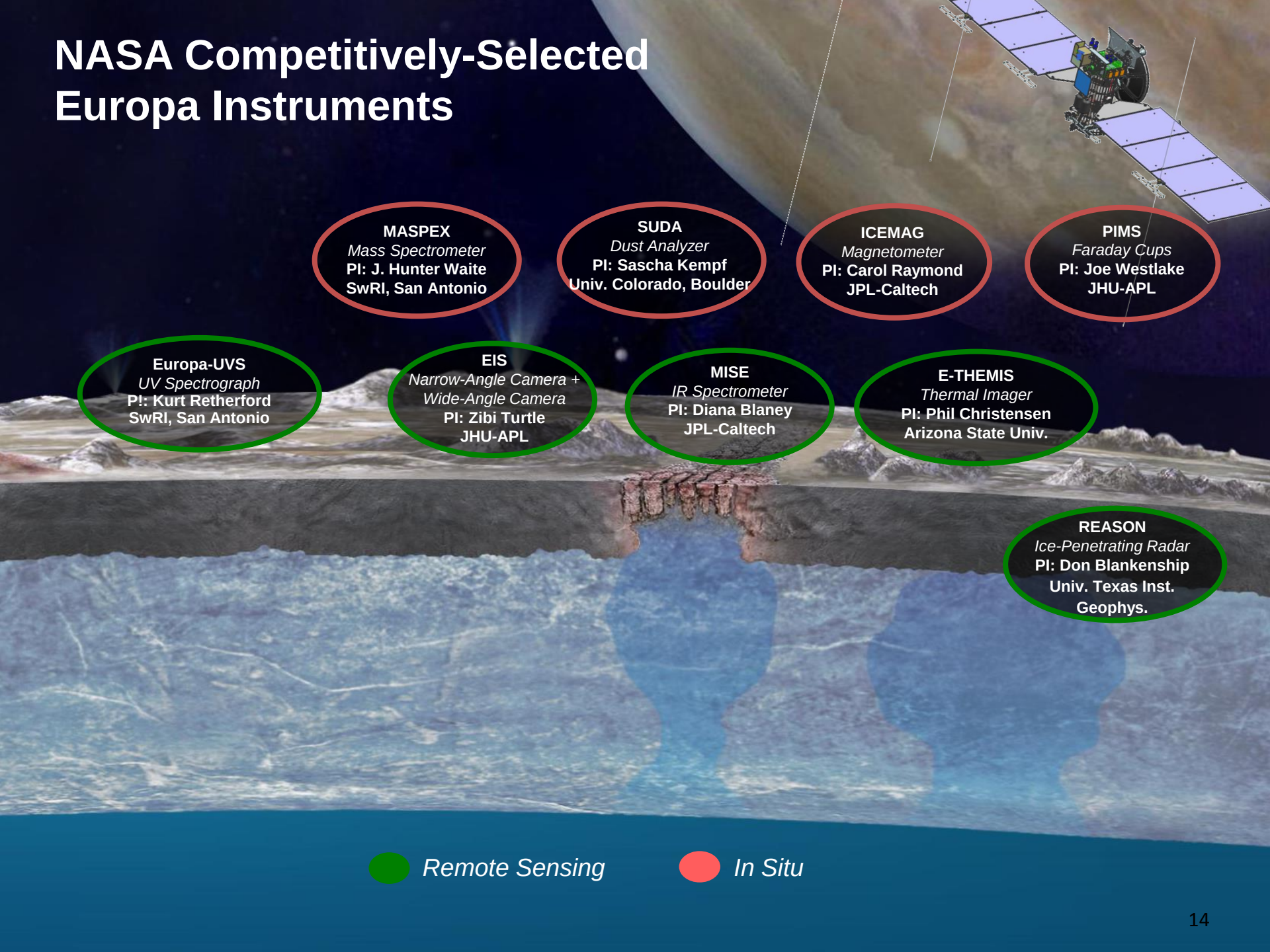
Europa Multi-Flyby Mission Concept Overview

Science	
Objective	**Description**
Ice Shell & Ocean	Characterize the ice shell and any subsurface water, including their heterogeneity, and the nature of surface-ice-ocean exchange
Composition	Understand the habitability of Europa's ocean through composition and chemistry.
Geology	Understand the formation of surface features, including sites of recent or current activity, and characterize high science interest localities.
Recon	Characterize scientifically compelling sites, and hazards for a potential future landed mission to Europa

- Conduct 45 low altitude flybys with lowest 25 km (less than the ice crust) and a vast majority below 100 km to obtain global regional coverage
- Traded enormous amounts of fuel used to get into Europa orbit for shielding (lower total dose)
- Simpler operations strategy
- No need for real time down link



NASA Competitively-Selected Europa Instruments



Europa Lander Science Definition Team

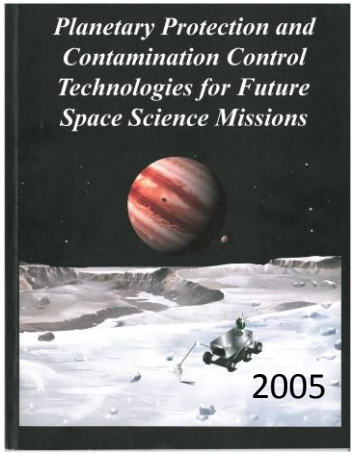
- Per congressional direction NASA is conducting pre-Phase A studies of a Europa lander mission
- The overarching science goals:
  - Search for evidence of biomarkers and/or extant life.
  - Assess the habitability of Europa via *in situ* techniques uniquely available by means of a landed mission.
  - Characterize surface properties at the scale of the lander to support future exploration including the local geologic context
- Established an 18-member Science Definition Team (SDT) to:
  - Define a hierarchy of prioritized science objectives and derived measurements
  - Develop a Science Traceability Matrix (STM) that flows from the top level science goals above through science objectives and derived measurements
- That final report is due to NASA Headquarters no later than September 30, 2016

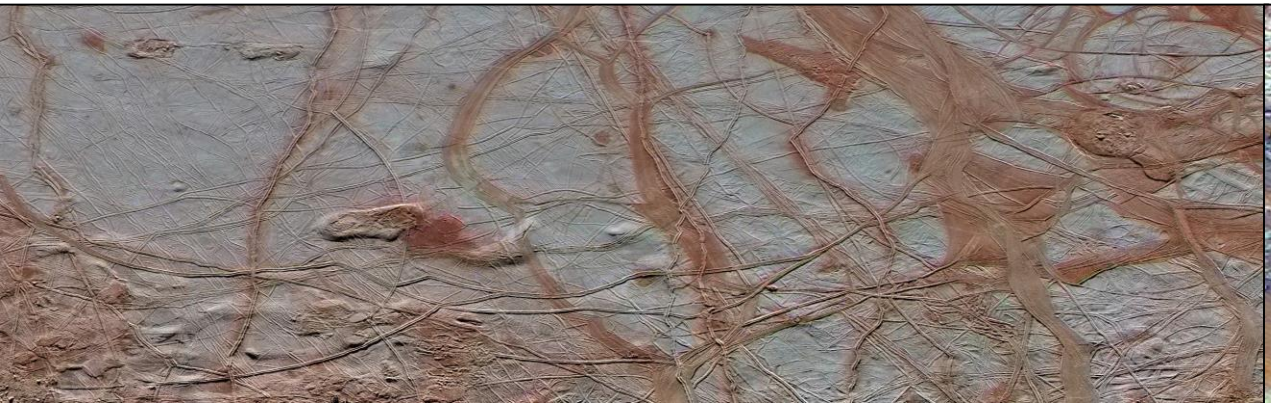
Instrument Technology Development

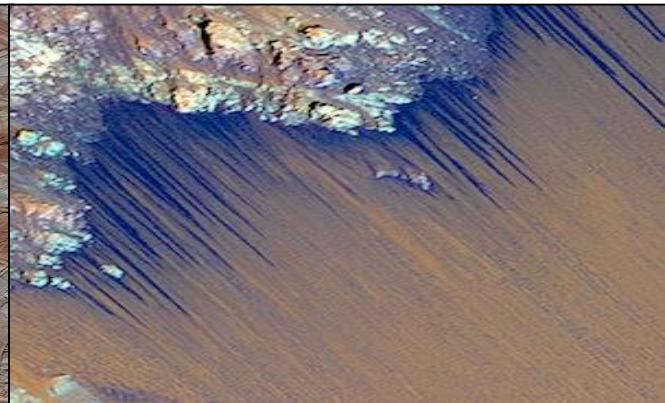
- Technical development of lander science instruments is needed prior to flight selection
  - Instrument readiness is a concern – many instruments to convincingly detect biomarkers and/or extant life are at low TRL
  - Such development is very applicable and beneficial to many planetary missions in addition to Europa lander
- Issued an instrument NRA (COLDTech) in May 2016 that will be followed by a lander AO at a later date
  - Same process used for the Europa Mission instruments
- This plan provides:
  - Sufficient time for developing instruments, maturing the mission concept, and settling programmatic issues;
  - Flexibility to respond to evolving programmatics and budgets

Planetary Protection Technology Definition Team

- Delineate planetary protection processes/techniques available or could be available to meet future planetary protection mission requirements
- Catalog materials & components compatible with planetary protection protocols
- Identify areas for technology development to verify processes or improve material compatibility
- Establish Team in late spring; report out by November
- ***Expected outcomes:***
  - ***Initial processes, techniques, and compatible materials list***
  - ***Identification of near-term research activities applicable to missions***
  - ***Provides Input for a Solicitation in ROSES 2017***

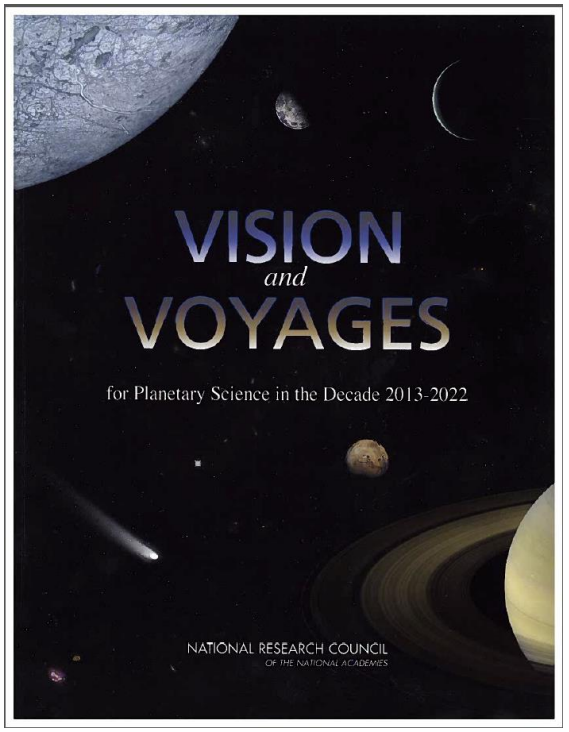






Timeline of National Academy Studies

- 1st Planetary decadal: 2002-2012
- 2nd Planetary decadal: 2013-2022
- Cubesat study completed May 2016
- Extended Missions Review:
  - Tasked April 30, 2015
  - Report due to NASA September 2016
- R&A Restructuring Review:
  - Tasked August 13, 2015
  - Report due to NASA December 2016
- Large Strategic NASA Science Missions
  - Tasked March 2016
  - Report due to NASA August 2017
- Midterm evaluation:
  - To be tasked by September 2016
  - Cubesat, Extended Missions, R&A Restructuring. & Large Strategic Missions will be input
  - Expect report due December 2017
- 3rd Planetary Decadal: 2023-2032
  - To be tasked *before* October 2019
  - Expect report to NASA due 1st quarter 2022



Questions?